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THE DETECTOR PACKAGE

for the

Laser Ranging Experiment at McDonald Observatory

Supplement II:

INTERPRETATATION OF STAR MEASUREMENTS

and OTHER SUPPLEMENTARY ITEMS

12 December 1969

Technical Report #957-B

S. K. Poultney



UNIVERSITY OF MARYLAND
DEPARTMENT OF PHYSICS AND ASTRONOMY
COLLEGE PARK, MARYLAND

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## APPENDIX X: Interpretation of Star Measurements

1. WHY A STAR MEASUREMENT.

A star measurement is a convenient means of checking the optimization of the transmission of the Perkin Elmer filter, monitoring the behaviour of the PMT, and checking for any gross misalignments of the receiver. It also allows a detail check of the receiver alignment from the diverging lens back through the detector package if done at night. It was after such a check in July that the best receiver efficiency was observed. Unfortunately, a star measurement is ambiguous due to possible PMT degradation or, more likely, due to seeing and atmospheric absorption. If the PMT becomes suspect, one should measure its quantum efficiency as described in Technical Report #958 and its single photoelectron level as described in Technical Report #957 and #958. An indication that either one of these possibilities has happened is a dark current count deviation from the normal one at $70^{C}$F.

To estimate the effect of seeing on receiver efficiency, one should interchange pinholes while observing the star. To eliminate its effect entirely, just remove the pinhole leaving a one centimeter aperture. Atmospheric absorption (or scattering) is less easily measured although halos and other high cirrus phenomena are usually an indication of severe absorption (or scattering). One possible monitor (without supplementary measurements) is to maintain a plot of lunar counting rate as a function of phase. One would not expect seeing to change drastically the lunar rate at Site 2. That loss in counting rate from the moon then gives an estimate of atmospheric absorption (or scattering).

## 2. INTERPRETATION OF A STAR MEASUREMENT

Red magnitudes of 1,325 Bright Stars are available[4] so that the time needed to point the telescope at a star can be kept to a low value. Star measurements can and should be done each day. Records of system configuration should be kept so that one may maintain uniformity with Table II. At present, a nominal factor of 4 is used to convert measurements with the 0.7Å filter to compare with 3Å filter measurements. The absolute counting rate expected from ALYR has been calculated in Section IX where receiver efficiency is discussed. Only relative changes from the ALYR rate need concern us here.

First, one must calculate the red(R)magnitudes from the V and V-R magnitudes listed in the Catalog[4]. Table IV gives an example

| Name | V | V-R | R |
|---|---|---|---|
| A LYR | 0.00 | -0.04 | +0.04 |
| A BOO | -0.06 | 0.98 | -1.04 |
| A SCO | 0.89 | 1.56 | -0.67 |
| A TAU | 0.86 | 1.22 | -0.36 |
| A AQL | 0.74 | 0.14 | +0.60 |
| B AND | 2.04 | 1.24 | +0.80 |
| A VIR | 0.96 | -0.09 | +1.05 |

Table IV: Red Magnitudes of Selected Stars

[4] B. Iriarte et al, Sky and Telescope, p. 21, July 1965

Second, one must use the red magnitudes to calculate the factor needed to adjust the observed rate to the rate comparable to ALYR in Table II. That calculation is done as follows using the definition of magnitude

$$m = -2.5 \log B \tag{1}$$

where B is the count rate and m the magnitude (i.e. V, V-R, R, etc.):

$$R_{\bar{X}} - R_{A\ LYR} = -2.5 \log \left\{ \frac{B_{\bar{X}}}{B_{A\ LYR}} \right\}$$

or

$$\frac{B_{\bar{X}}}{B_{A\ LYR}} = \text{anti log} \left\{ \frac{R_{A\ LYR} - R}{2.5} \right\} \tag{2}$$

For example, chosing A BOO

$$R_{A\ LYR} - R_{A\ BOO} = +1.08$$

and so

$$\log \frac{B_{A\ BOO}}{B_{A\ LYR}} = +0.432$$

or

$$B_{A\ BOO} = 2.7\ B_{A\ LYR}$$

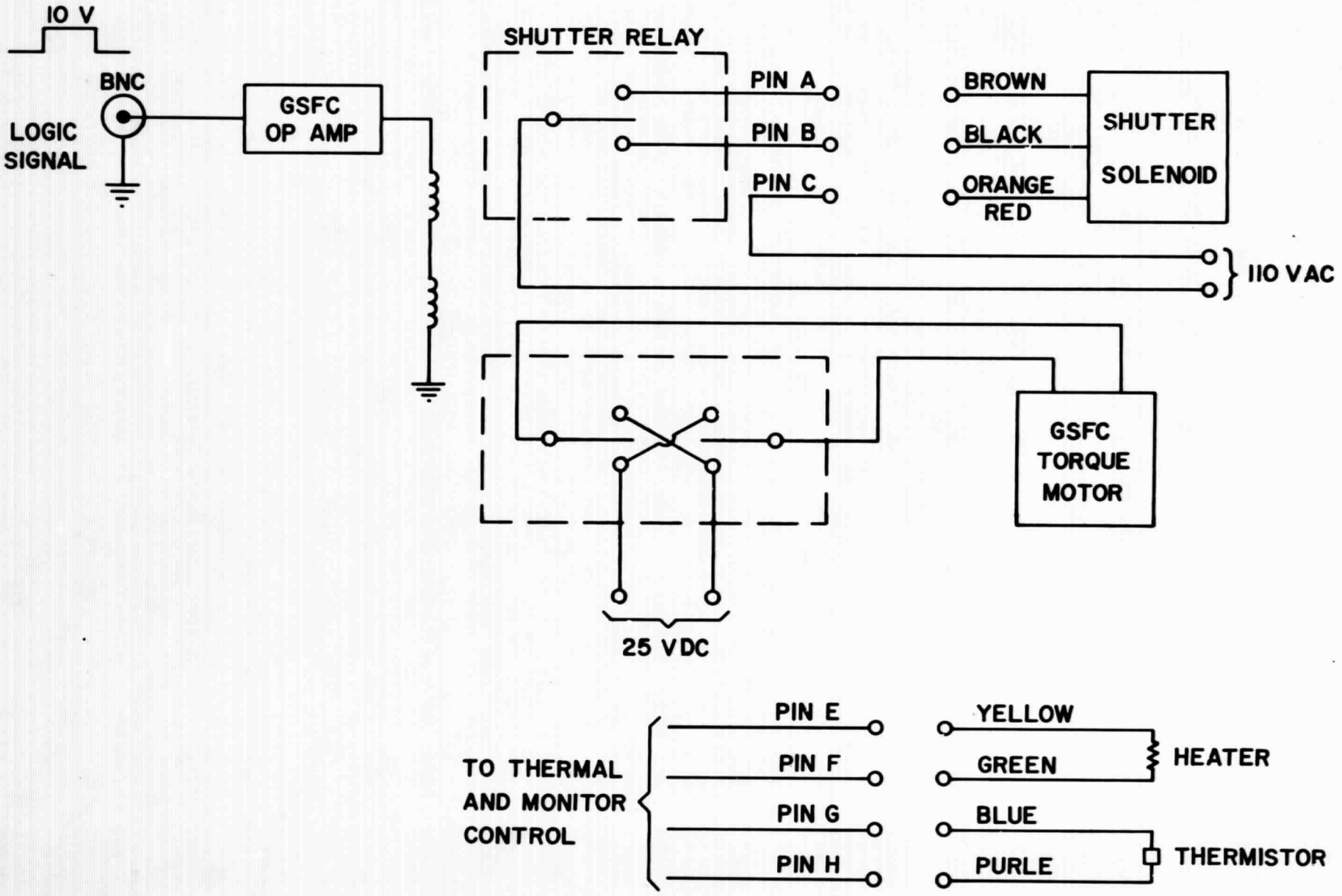
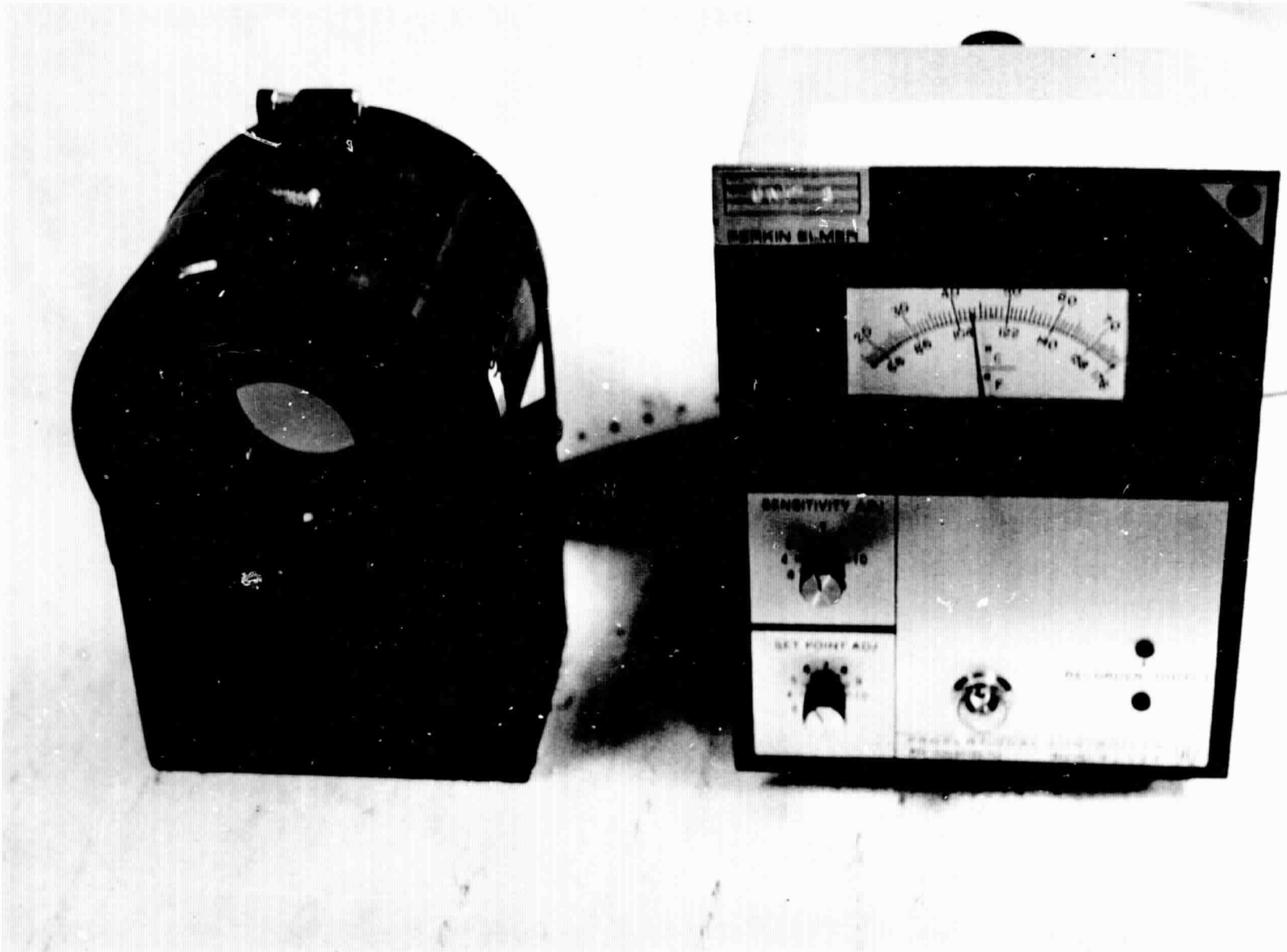



Fig. 11 SHUTTER DRIVER AND DETECTOR PACKAGE WIRING DETAILS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